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Observations for climate: Sustained ocean observing system for tropical Atlantic variability

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The tropical Atlantic is influenced by two main modes of variability on interannual to decadal timescales: the Atlantic Meridional Mode and the Atlantic Nino. The Meridional Mode is characterized by changes in sea surface temperature (SST) and surface winds between the hemispheres. Coupled ocean-atmosphere variability associated with this mode contributes to rainfall variability over Brazil and Africa and affects tropical cyclone development in the North Atlantic. The Nino mode is distinguished by irregular warming and cooling of the eastern equatorial Atlantic cold tongue of SST. This mode influences rainfall in equatorial Africa and atmospheric circulation in the eastern equatorial Pacific. Both modes are superimposed on a strong annual cycle in the tropical Atlantic. In the past decade the sustained ocean observing system in the tropical Atlantic has grown considerably, enabling a better understanding of the role of the ocean in tropical Atlantic variability. Buoys of the Prediction and Research Moored Array in the Tropical Atlantic (PIRATA) have been providing subsurface measurements of temperature, salinity, and velocity as well as surface meteorological parameters since 1998. Argo floats record ocean temperature and salinity profiles every 5-10 days, and can also be used to derive subsurface horizontal currents. Drifting buoys measure sea surface temperature and salinity while following water in the mixed layer. Expendable Bathythermograph (XBT) profiles from merchant ships allow mapping of horizontal depth-dependent currents at a high spatial resolution along the cruise tracks. This poster highlights progress made toward understanding the role of the ocean in tropical Atlantic variability, focusing on what has been learned from measurements of the sustained ocean observing system. Key results include objective mapping of surface currents in the tropical Atlantic from drifting buoys, which has improved our knowledge of the seasonal ocean circulation and heat transport. Surface drifter tracks, together with XBT profiles and Argo, have been used to quantify intraseasonal to interannual variability of the North Equatorial Countercurrent and Undercurrent as well as deep (800-1100 m) zonal currents in the equatorial Atlantic, and their relationships with the tropical Atlantic climate modes. Shipboard acoustic Doppler current profiler sections obtained during PIRATA cruises and in the framework of the Tropical Atlantic Climate Experiment (TACE) have characterized meridional currents across the equatorial Atlantic cold tongue, and measurements from PIRATA and Argo have revealed the importance of mixed layer dynamics in driving year to year variability of the Meridional Mode. These results highlight the importance of the ocean in tropical Atlantic variability and the need for continued long-term sustained ocean observations for climate research in the tropical Atlantic.